Littleton Drainage System Mapping and Modeling
Quality Assurance Project Plan

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A3 – Distribution List

Table 1 presents a list of people who will receive the approved QAPP, the QAPP revisions, and any amendments.

Table 1. QAPP Distribution List

QAPP Recipient Name	Project Role	Organization	Telephone number and Email address
Cathy Conway	Project Manager	Town of Littleton	603-444-3996 ext 17 cconway@townoflittleton.org
Tim Breen	Quality Assurance Manager	COSEED	603-444-3996
Kevin Flanders	Stormdrain Mapping Data Manager	PeopleGIS	617-625-3806 kevin@peoplegis.com
High School Science Teacher	Sampling Coordination & Education	Littleton High School	603-444-3402
Students	Sampling	Littleton High School	603-444-3402
Rachel Rainey	Laboratory QA Officer	NHDES Laboratory	603-271-2993 rrainey@des.state.nh.us
Andrea Donlon	Program QA Coordinator	NHDES Watershed Management Bureau	603-271-8862 adonlon@des.state.nh.us
Vincent Perelli	NHDES Quality Assurance Manager	NH DES Planning Unit	603-271-8989 vperelli@des.state.nh.us
Warren Howard	USEPA Project Manager	USEPA New England	617-918-1587 Howard.Warren@epamail.epa.gov
Charles Porfert	USEPA Quality Assurance Unit	USEPA New England	617-918-8313 porfert.Charlie@epa.gov

Based on EPA-NE Worksheet #3

A4 – Project/Task Organization

The primary contact for NHDES and the EPA will be Cathy Conway, Public Works Director for the Town of Littleton, New Hampshire. Cathy will be responsible for maintaining the QAPP and overseeing project activities.

Tim Breen will coordinate project activities with the High School Science teacher and will report to Cathy Conway. Tim will also serve as the Project Quality Assurance Officer, being responsible for resolving problems raised by the laboratory. Tim Breen will arrange for sample delivery and will also be responsible for notifying the laboratory.

The laboratory will be the NHDES laboratory, and the QA laboratory manager is Rachel Rainey.

Data will be released to the public through the Littleton Conservation Commission. The project manager, Cathy Conway will amend the QAPP if project activities are modified. Tim Breen in consultation with the project manager will make changes to the schedule.

Kevin Flanders, of People GIS, will be responsible for stormdrain mapping data management, system modeling, development of applications and coordination of public informational handout and web page.

Kevin will also train the high school students on the use of GPS equipment and coordinate the student activities to GPS locate drainage structures.

The High School Science teacher and students will be responsible for collecting the samples. The instructions during storm sampling will be initiated by the Science teacher and will be accomplished with a phone tree. Corrective actions for sampling will be communicated from Tim Breen to the High School Science teacher.

The principal data users will be the Town of Littleton, specifically the Public Works Department, the Fire Department and the Police Department. The Board of Selectmen and Town Manager will also utilize the data. The collected data will also be used for educational purposes.

Progress will be reported verbally, followed up by written reports.

Figure 1 shows an organizational chart for this project.

Figure 1. Project organizational chart

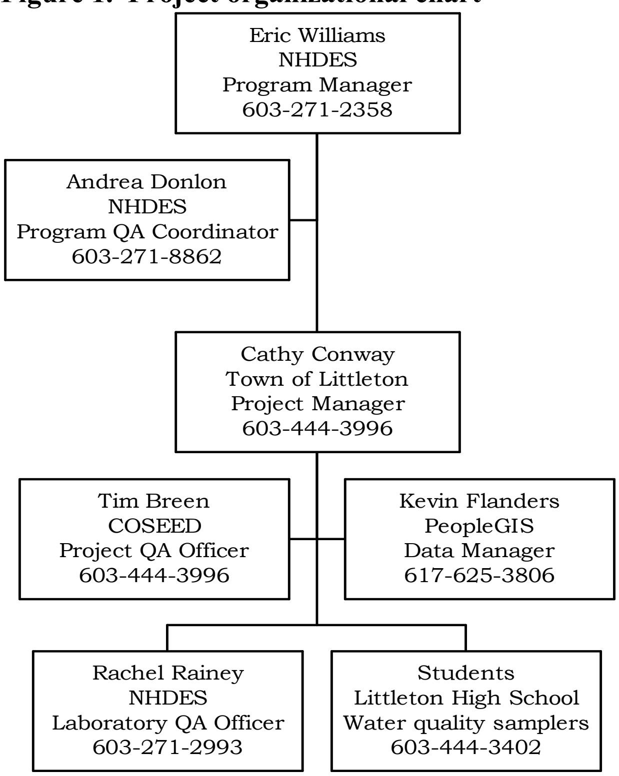


Table 2. Personnel Responsibilities and Qualifications

Name and Affiliation	Responsibilities	Qualifications
Cathy Conway, Town of Littleton	Project Manager	On file at Town of Littleton
Tim Breen, COSEED	Project Quality Assurance	On file at Town of Littleton
Kevin Flanders, People GIS	Coordinate Data Collection & Data Management	On file at Town of Littleton
Science Teacher, Littleton High School	Coordinate Sampling	On file at Littleton High School
Students, Littleton High School	Complete Sampling	
Rachel Rainey NH DES Laboratory Services	Oversees laboratory QA/QC activities and identifies necessary corrective actions.	On file at NHDES
Andrea Donlon NH DES Watershed Management Bureau	Reviews QAPP preparation and other QA/QC activities	On file at NHDES
Charles Porfert EPA Region I Laboratory	Responsible for review and approval of QAPP	On file at EPA

Based on EPA-NE Worksheet #6.

A5 – Problem Definition/Background

Water quality problems in the Ammonoosuc River date back to before 1900 when sewage, industrial waste, and other pollutants were dumped directly into the river. In the 1970's, water quality in the study area was below state standards for a Class B (swimmable and fishable) surface water, with bacteria and pollutants present. After the passage of the Clean Water Act in 1971, the federal and state government spent a substantial amount of money to upgrade municipal sewage treatment plants and other point sources of pollution, including upgrades to Bethlehem's and Littleton's waste treatment facilities. Yet in the 1990 Connecticut River Basin Water Quality Management Plan (NHDES), a 26 mile stretch of the river, from Bethlehem south, did not meet Class B standards. Today, while the river does meet the limited Class B standards throughout its length there are still water quality issues in the River above and below Littleton, which include point and non-point sources.

Previous relevant data surveys include sampling completed by Lobdell and Associates in 2000 as well as sampling by the NHDES at stations located in Bethlehem at the Hazen Road Bridge, in Littleton at the former Bridge Street Bridge and in Lisbon at Barretts Crossing Bridge. Overall, the water quality has improved over the past 25 years. Bacteria levels are generally down and dissolved oxygen is excellent. However, the NHDES samples in the Ammonoosuc raise concerns with some indicators including conductivity, E. coli bacteria, phosphorous and some metals exceeding standards or aquatic guidelines for streams.

Table 3 Water Quality Sampling by Lobdell Associates in 2000

Station	Water-shed *	Turbidity (FTU)			pH (units)			Conductivity (uS)			Nitrates (mg/l)			Phosphorus (PO4) (mg/l)		
Date		9/30	10/30	11/11	9/30	10/30	11/11	9/30	10/30	11/11	9/30	10/30	11/11	9/30	10/30	11/11
1	1	0.49	3.1	1.5	7.09	6.87	6.29		250	199.8	0.4	0.3	0.4	>10	8.5	20.9
10	1			229.0			6.57			43.9			0			24.0
3	1	1.92	2.3	4.4	7.16	6.68	6.26		234	234.5	0.4	0.4	0.3	4.69	63	4.9
6	1		3.8			6.72			194			0.4			1.2	
4	2	1.24	2.93	2.6	7.42	6.86	6.52		96	89.4	0.3	0.3	4.3	5.21	47.0	1.4
8	2			1.38			6.6			38.1			4.5			8.4
9	2			1.92			6.63			28.4			0.3			5.8
2	Ammo	6.04	0.4	6.6	7.79	7.66	6.78		59	33.3	0.4	0.4	0.4	>10	31.0	2.5
5	Ammo	0	0.22	4.8	7.83	7.59	6.8		52	38.9	0.3	0.4	0.5	>10	12.0	2.0
7	Ammo		0	4.3		7.19	6.91		57	30.8		0.4	40.		6.4	6.8

* This sampling was completed east of the project area and can be identified as follows:
Watershed 1 is the Dells Brook watershed
Watershed 2 is the Walker Mountain watershed
Ammo is sampling in the Ammonoosuc River

A site map with the zoning overlay showing current land use is attached (Appendix B) as well as a drainage system modeling map (Appendix C).

The environmental problem that this study will look at is non point source pollution and sediment from urban run-off that may be affecting the water quality in the Ammonoosuc River. Culverts carry unknown contaminants such as road sand or salt and gasoline or oil from in-town streets to the Ammonoosuc River as well as some combined storm-sanitary sewers. The effect of winter road maintenance on water quality will be studied to determine if salt and sand are adversely affecting water quality during winter storm operations.

The Town of Littleton proposes to map drainage structures in the community using Global Positioning Systems (GPS) and to utilize this information for various maps and stormwater runoff modeling. With accurate drainage maps, the Highway Department will be able to explore Best Management Practice (BMP) alternatives for ice and snow removal. Knowing and understanding the flow of surface water from our roads to the river will enable us to better plan for sweeping or removal of the material. Results may range from reduced salt/sand areas based on proximity and travel time to the river or other water bodies to more sophisticated equipment for spreading the material more accurately and only when conditions warrant its usefulness. Modeling of the "in-town" area of the system will be utilized to test various scenarios on improving water quality. The scenarios will include reduced salt or sand usage and/or use of alternative chemicals and better equipment for measuring the quantity of material spread. As part of this project, baseline and year one water quality samples will be taken from the Ammonoosuc River in four locations.

The Littleton Community understands and realizes the importance of the Ammonoosuc River. The Town is currently developing a Riverwalk along the banks of the river. We are also looking at an environmental museum/discovery center and working with CO-SEED on Community Based Environmental Education. We believe this project will enhance and continue such on-going efforts

The data gathered will be used to determine the extent of the contamination in the Ammonoosuc River from road sand and salt. In addition, by sharing the mapping products developed by this project with all town departments through Littleton's GIS, the information will also serve a variety of additional purposes, thereby providing a higher return on our investment. For example, Public Safety has advised us of their opportunity to benefit from the stormwater model when responding to an emergency scene where hazardous material has leaked into the storm drainage system. In this situation, emergency personnel can utilize the data to effectively respond to potential threat to human life and environmental conditions. The results of the study will be posted on the web site, mailed with water or tax bills and presented at Conservation Committee meetings.

The project is designed to determine if winter maintenance practices need to be revised and additional Best Management Practices implemented. It will help to achieve a reduction in non point pollution in the water body.

The principal data users will be the Public Works Director in conjunction with the Board of Selectmen and Town Manager.

A6 – Project/Task Description

Does winter road maintenance, specifically the application of road sand and salt, affect the water quality of the Ammonoosuc River? In order to determine if there is an effect, the following procedure is proposed.

- The catch basin locations and outlets to the river in the study area will be GPS located and mapped
- The subwatersheds will be delineated and characterized
- Two of the five subwatersheds that have similar characteristics will be selected for sampling. Sampling for sodium chloride and total suspended solids will occur at the culvert outlets of the selected subwatersheds.
- In stream sampling will be completed above the study area and below the study area.
- Flow data for the stream will be collected from the USGS Stream Gaging Stations located above the study area (Bethlehem) and below the study area (Lisbon)
- Flow data for the culverts will be collected at the time of sampling using a simple weir.

Initial sampling will be conducted during late fall prior to the Highway department initiating winter operations. Sampling will include flow measurement at the culverts, data collection of flows from the USGS Stream Gaging Stations and the collection of water samples for analysis by the lab.

Additional sampling will occur during snow melt. The degree day model will be utilized to sum temperatures above the melting point to determine the melting potential of the snow. Once a pre-determined level has been reached, sampling will occur within six hours. The procedure will be the same as the fall sampling. The snow melt sampling will likely occur during a typical January thaw and again in the spring.

Between the January thaw and the spring sampling, the Highway department will modify its approach in one of the subwatersheds to determine if it can reasonably decrease the concentrations of salt or sand in the samples. The other subwatershed will remain unchanged as a control.

The results of the fall, winter and spring sampling events will be normalized and compared to determine the effect of winter operations on salt and sand concentrations.

The map in Appendix D shows the location of the sampling points.

Table 4. Project Schedule Timeline

Activity	Dates (MM/DD/YYYY)		Product	Due Date
	Anticipated Date(s) of Initiation	Anticipated Date(s) of Completion		
QAPP Preparation	May 2002	Oct. 2002	QAPP Document	
Sampling	Nov. 2002	May 2003	Samples collected	
Laboratory analyses	Oct. 2002	May 2003	Sample Data	
Data validation	May 2003	June 2003	Report	
Data assessment report	June 2003	July 2003	Report	
Final project report preparation	July 2003	Sept. 2003	Report	

Based on EPA-NE Worksheet #10.

A7 – Quality Objectives and Criteria

Table 5 summarizes the performance criteria for samples collected for this project

Table 5. Measurement Performance Criteria for Surface Water Samples

Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance
Precision-Overall	Relative Percent Difference < 20%	Field Duplicates
Precision-Lab	RPD < 10%	Lab duplicates
Accuracy/Bias	RPD <10%	Spikes/Duplicates
Comparability	Deviation from SOPs should not influence more than 5% of the data	Data Comparability Check
Sensitivity	Percent Recovery = ± 10% for Cl Not applicable for TSS	Laboratory Fortified Blanks
Data Completeness	90% samples collected	Data Completeness Check

Based on EPA-NE QAPP Workbook for 3/19/02 DES QAPP writing class.

Precision: Precision will be measured by analyzing sample replicates and determining if those replicates fall within the critical range for that testing protocol. If the replicate falls within the critical range, the precision will be acceptable. If the replicate falls outside of the critical range, the sample will be run again to determine if there was an error in the analyzer or the equipment that led to the imprecision. Duplicate precision will be analyzed by calculating the relative percent difference (RPD) using the equation:

$$RPD = \frac{|x_1 - x_2|}{\left(\frac{x_1 + x_2}{2}\right)} \times 100\%$$

where x_1 is the original sample concentration
x_2 is the duplicate sample concentration

RPDs < 20% will be deemed acceptable

Accuracy/Bias. As an indicator of measurement confidence, percent accuracy will be calculated based on analytical results of spiked samples of known chemical concentrations for chloride:

$$\%Accuracy / Bias = \frac{SpikedSampleConc. - UnspikedSampleConc.}{SpikedConc.Added} \times 100\%$$

For turbidity, accuracy is expressed as the difference between the mean measured value and the theoretical value.

The accuracy of the GPS unit used to mark sampling locations will be ± 1 meter.

Representativeness: The sampling locations were selected to be representative of the environmental conditions found in the river and watersheds.

Comparability: Standard operating procedures will be followed when collecting and analyzing the samples to ensure data comparability.

Sensitivity. Background information will be analyzed on the Ammonoosuc River to determine that the methods and instruments are able to detect the concentration of chloride at the level of interest. Detectable ranges of the methods and the equipment (as shown in methods and SOPs) are adequate for the purposes of this study design.

Quantitation Limits. The analytical method, analytical/achievable method detection limit, and the analytical/achievable laboratory quantitation limits for this project are shown below in Table 6.

Table 6. Surface Water Target Analytes and Reference Limits

Analyte	Analytical method (See Appendix [] for SOP Reference)	Project Action Level (mg/L)	Analytical/Achievable Method Detection Limit	Project Quantitation Limit
Chloride	EPA 300.0	860,000	2 mg/L	10mg/L
TSS	EPA 160.2	NA	1 mg/L	5 mg/L

Based on EPA-NE Worksheet #9b and 9c.

Completeness: Given the inherent difficulty in collecting snowmelt samples at specific points during a melting event, there will likely be times in which incomplete sampling will occur. The goal for completeness is 75% for all parameters.

A8 – Special Training/Certification

Table 7. Special Personnel Training Requirements

Project function	Description of Training	Training Provided by	Training Provided to	Location of Training Records
Field Sampling	Overview of standard operating procedures for sample collection	Science Teacher	High School Science Students	Littleton High School
GPS Data collection	Overview of procedures for data collection with GPS unit	People GIS	High School GPS class	Littleton High School
Salt Application	Overview of procedures for use of spreader control equipment	Manufacturer	Highway Staff	Littleton Highway Department

Based on EPA-NE Worksheet #7.

A9 – Documents and Records

The records and documents generated in association with the sampling include the following:

- Field Notes & Data Sheets
- Chain of custody forms
- Corrective action logs
- Sign in sheet for training sessions

The high school science teacher will be responsible for the sampling records.

The data report package for field testing will contain all data information and records to reproduce reported results and will include the following:

- Standards calibration log
- Equipment calibration log
- Duplicates

The high school science teacher will be responsible for field testing records.

The data report package for fixed laboratory analyses will contain all data information and records to reproduce reported results and will include the following:

- Water quality results from the lab
- QC sample results
- Tracking and custody records

The quality assurance manager will be responsible for obtaining reports from the laboratory.

The public informational report will include a tri-fold brochure outlining the project and its results and will be completed by students with the assistance of People GIS.

As part of the grant requirement, the project manager will prepare and submit a final project report to DES and EPA by the expiration date of the contract, December 31, 2004. The final report will include the following details: all sample results, sample locations and dates, chain of custody records, interpretation of the results, GIS generated maps, and conclusions and recommendations.

The procedures for filing, archiving, and disposing of project records is the same as managing all municipal records. The documents will be held for at least seven years and stored in the municipal vault.

B1 – Sampling Process Design

Four sampling locations have been selected. Two locations are in stream and two are at the discharge culverts for subwatersheds in the study area. The discharge points have been selected in subwatersheds that have similar characteristics in order to assess the changes in concentrations after best management practices are implemented by the highway department in one of the subwatersheds. The sampling in the River will be conducted upstream and downstream of the study area to determine if the winter operations in the study area (downtown Littleton) have an effect on the concentrations of chloride and Total Suspended Solids in the Ammonoosuc River.

Sampling will be conducted on at least three different occasions. The first round of sampling will be completed during the fall prior to winter operations to establish base line data. The second round of sampling will occur during snow melt. The degree day model will be utilized to sum temperatures above the melting point to determine the melting potential of the snow. Once a pre-determined level has been reached, sampling will occur within six hours. The procedure will be the same as the fall sampling. The snow melt sampling will likely occur during a typical January thaw and again in the spring. Between the January thaw and the spring sampling, the Highway department will modify its approach in one of the subwatersheds to determine if it can reasonably decrease the concentrations of salt or sand in the samples. The other subwatershed will remain unchanged as a control.

The parameters that will be sampled include total suspended solids and chloride. In addition, flow measurement at the culvert outlet will be obtained with a weir and stream flow will be determined from existing USGS gauging stations. Flow data is necessary to be able to normalize and compare the concentration results.

Table 8. Surface Water Field Sample Summary

Parameter	No. of sampling locations	Samples per event per site	Number of sampling events	Number of field duplicates	Total number to lab
To be analyzed at the DES lab					
Chloride	4	2	1 before winter ops, 1 during snow melt and 1 after BMP implementation	1/sampling event = 3	30
Total Suspended Solids	4	2	1 before winter ops, 1 during snow melt and 1 after BMP implementation	1/sampling event = 3	30
Measured in the field					
Flow	2	4	1 before winter ops, 1 during snow melt and 1 after BMP implementation	1 re-measurement/ event	measured *in situ*

Based on EPA-NE Worksheet #9c.

B2 – Sampling Methods

Sampling will be completed on two subwatersheds entering the Ammonoosuc River and in the Ammonoosuc River above and below the study area. Sampling will be completed in the fall to establish base line information, during winter snow melt as determined from the degree day model and again in the spring after best management practices have been implemented at one of the watersheds.

Preparation of Sampling Containers

- Five 250-mL HDPE sample bottles will be prepared by the laboratory and sent in a cooler
- Prior to sampling pick up cooler and bottles. Check to make sure the appropriate number of sample bottles are in the cooler

Safety

- Always monitor with at least one partner and let someone know where you are going and when you plan to return
- Check your site maps, be sure of your location
- Know important medical conditions of all team members and pack appropriate medicines.
- Have a first aid kit handy
- Be aware of farm animals, dogs, wildlife and insects
- Watch for plants that may cause irritations
- Be sure to wash your hands thoroughly
- Wear waders and rubber gloves if you feel the stream may be significantly polluted. Pay attention to the weather, never sample in severe weather
- Do not wade into high water, flood waters and/or fast moving streams. So not wade into water above your knee in depth.
- Park in a safe location, be aware of passing traffic, do not block traffic
- Sample at public access points if possible
- Do not walk on unstable stream banks

- When sampling in a stream one team member should wait on dry land. Be careful of slippery rock bottoms, deep pools and muddy-bottoms
- Pay attention to your feelings, if at any time you feel uncomfortable about your surrounds, stop and leave the site at once. Your safety is more important than the data

Basic Equipment The following equipment is optional but will enhance safety and effectiveness of samplers

- Boots or waders
- Walking stick for balance, probing and measuring
- Bright colored snag and thorn resistant clothes, long sleeves and pants are best
- Rubber gloves to guard against contamination
- Insect repellent and sun screen
- Whistle to summon help in emergencies
- Drinking water
- Clipboard
- Several pencils
- Tape measure
- Field data sheet

Stream Sampling

- Determine if water is flowing. If this is not within arm's reach of the shore use the extension pole. Do not sample water that is not flowing
- Label the bottle with the site number, date and time
- Remove the cap from the bottle just before sampling. Avoid touching the inside of the bottle or the cap.
- Disturb as little bottom sediment as possible. Stand facing upstream. Collect the water sample on your upstream side, in front of you. You may also tape your bottle to an extension pole to sample from deeper water.
- Hold the bottle near its base and plunge it (opening downward) below the water surface. If you are using an extension pole, remove the cap, turn the bottle upside down, and plunge it into the water, facing upstream. Collect a water sample mid-way between the surface and the bottom of the stream.
- Turn the bottle underwater into the current and away from.
- Leave a 1-inch air space. Do not fill the bottle completely. Recap the bottle carefully, remembering not to touch the inside.
- Fill in the bottle number and/or site number on the appropriate field data sheet.
- Place the samples in the cooler for transport to the lab.

Collecting Quality Control Samples

- One duplicate sample will be collected for each sampling event. The collection of duplicate samples will be rotated among all sampling locations. Samples will be collected in exactly the same manner as the regular sample.
- No field blanks will be collected because clean sample bottles are provided by the NHDES laboratory, and these bottles are not expected to introduce contaminants into the samples.
- Duplicate flow measurements (see below) will be taken once per sampling event. The High School Teacher will call any major discrepancies between the first and second measurements to the QA Manager and Project Manager. If necessary, samplers will be retrained to measure flow consistently.

Measuring Stream Flow
Stream flow will be determined from upstream and downsteam USGS gauging stations. Culvert flow will be determined utilizing a weir. A simple v-notch weir will be inserted at the culvert outlet and the height of flow in the weir will be measured to the nearest 0.1 foot. The Bernoulli equation will be used to convert the height measurement to flow rate.

The set up of the temporary v-notch weir is as follows: The weir shall be constructed from a piece of stiff sheet metal cut in the approximate shape of the cross section of the culvert with the angle of the v cut to 90 degrees, and installed in a bulkhead that has been sandbagged and sealed in place. The v-notch weir shall be installed so that all the flow passes over the weir. The weir shall be placed level and perpendicular to the direction of flow. The water elevation shall be recorded slightly upstream of the weir and the elevation of the lowest portion of the weir crest shall be recorded to determine H. The flow rate can then be calculated from H. (Reference the US Department of the Interior Bureau of Reclamation 3rd edition of the Water Measurement Manual at www.usbr.gov/wrrl/fmt/wmm) and the Field Manual for Phase I of the San Luis Obispo Creek Watershed Monitoring Program at http://www.fix.net/~mamcewen/documents.html).

Table 9. Sample Requirements

Analytical parameter	Collection method	Sampling SOP	Sample volume	Container size and type	Preservation requirements	Max. holding time (preparation and analysis)
Chloride	Grab	See above	50 mL	250 mL HDPE	None	28 days
TSS	Grab	See above	100 mL	250 mL HDPE	chilled to 4ºC	7 days

Based on EPA-NE Worksheet #12b.

B3 – Sample Handling and Custody

Sample Handling
- The laboratory will supply sample bottles. No preservatives are required in the bottles. After obtaining a sample, the sample will be placed in a cooler for same day shipment by overnight courier back to the laboratory. Table 9 gives preservation requirements and holding times for samples.

Field Tracking
- Samples will be numbered according to the sample site ID # shown on the sampling map and dated.

Custody Requirements
- A chain of custody report will be completed by all samplers, the science teacher will then collect all samples and ship back to the laboratory with the chain of custody form included
- The lab will complete chain of custody form and return with sample results. The lab will follow its internal control procedures for lab id numbering, storage, retrieval and disposal.

Personnel who will be performing these tasks include the students completing the sample and the science teacher coordinating the student efforts.

Chain of custody form will be obtained from the lab with sample bottles
Sample tag will also be obtained from the lab.

B4 – Analytical Methods

There will be no analysis completed in the field.

Laboratory analysis will be completed following standard procedures. Chloride will be analyzed using EPA method 300.00 and Total Suspended Solids will be analyzed with EPA method 160.2. Laboratory analysis will be completed at the NHDES laboratory following procedures on file at EPA.

Corrective action to sampling and analytical personnel will be communicated through Tim Breen. Tim Breen will communicate with the samplers and project manager who will determine if re-sampling is required. Analytical problems raised by the lab will be addressed by the Quality Assurance Manager, Tim Breen.

B5 – Quality Control

The following table summarizes the quality control samples used by field personnel and the lab. Field duplicates will be taken at a minimum of one station during each sampling event. Duplicate flow measurements will be collected at the weirs installed in the culverts to determine the precision of the flow measurement. This will be done by reading the measurement device twice. At least one duplicate measurement needs to be performed during each sampling event.

Table 10. Fixed Laboratory Analytical QC Sample Table

	Frequency of				
Analyte	**laboratory duplicate**	**lab fortified matrix spike**	**lab fortified blank (QC standard)**	**lab reagent blank**	**independent calibration verification (QC standard)**
Chloride	1 in 10	1 in 10	Once at the beginning of run	Once at the beginning of run	at beginning of tray after calibration
Total Suspended Solids	1 in 10	NA	Once per run	NA	Once per run

Loosely based on EPA-NE Worksheet #24b.

B6 – Instrument/Equipment Testing, Inspection, Maintenance

The NHDES laboratory quality assurance manual is on file at the EPA.

B7 – Instrument/Equipment Calibration and Frequency

The instrument/equipment calibration information for NHDES lab is on file at EPA.

B8 – Inspection/Acceptance Requirements for Supplies and Consumables

The laboratory will supply clean sample bottles. A visual inspection will be completed prior to each sampling event.

B9 – Non-direct Measurements

The non-direct measurement that will be used is weather data from the national Weather Service and electronic stream flow data from the USGS river gauging stations.

B10 – Data Management

Chain of custody documentation will be maintained. Data sheets will be reviewed for completeness and for holding time by the project Quality assurance officer. The Town of Littleton will be the recipient of the water quality results from the lab. The final report will be written by the Town of Littleton.

C1 – Assessments and Response Actions

The Littleton High School science teacher will serve as the field coordinator for the sampling.

Table 11. Project Assessment Table

Assessment Type	Frequency	Person responsible for performing assessment	Person responsible for responding to assessment findings	Person responsible for monitoring effectiveness of corrective actions
Field sampling audit	Once at beginning of study	High School Science Teacher	High School Science Teacher	High School Science Teacher
Field analytical assessment	Once at beginning of study	High School Science Teacher	High School Science Teacher	High School Science Teacher

C2 – Reports to Management

A final report will be issued to the Department of Environmental Services on the project status. The project manager, Cathy Conway will be responsible for completing the report.

D1 – Data Review, Verification and Validation

The Project Manager will review all monitoring results and evaluate QC requirements for usability in obtaining the stated objectives of the project based on the criteria established in Tables 5 and 6, and the QC criteria in Section B5.

D2 – Verification and Validation Procedures

Field and laboratory data are submitted to the Project Manager. The Project Manager reviews all field data for completeness by making sure all entries on the data sheets are filled out. The Project manager makes sure that any questionable entries are verified by speaking to the sampling team or reviewing the field data sheets, and noting any unusual or anomalous data in the project files.

The Project Manager reviews the lab data by looking at the lab narrative and the quality control sample results to see if the data are qualified. Any decisions made regarding the usability of the data will be left to the Project Manager, however the Project Manager may consult with project personnel, NHDES QA staff, or with personnel from EPA-NE

D3 – Reconciliation with User Requirements

If the project objectives from Section A7 are met, the user requirements have been met. If the project objectives have not been met, corrective action as discussed in D2 will be established by the Project Manager prior to the next monitoring event.

Appendix A

Town of Littleton
Drainage System Mapping and Modeling
Water Sampling Data / Field Sheet

Water Body ________Ammonoosuc River__ Date: _____________

Time: _____________

Observers ____ Site # _____________

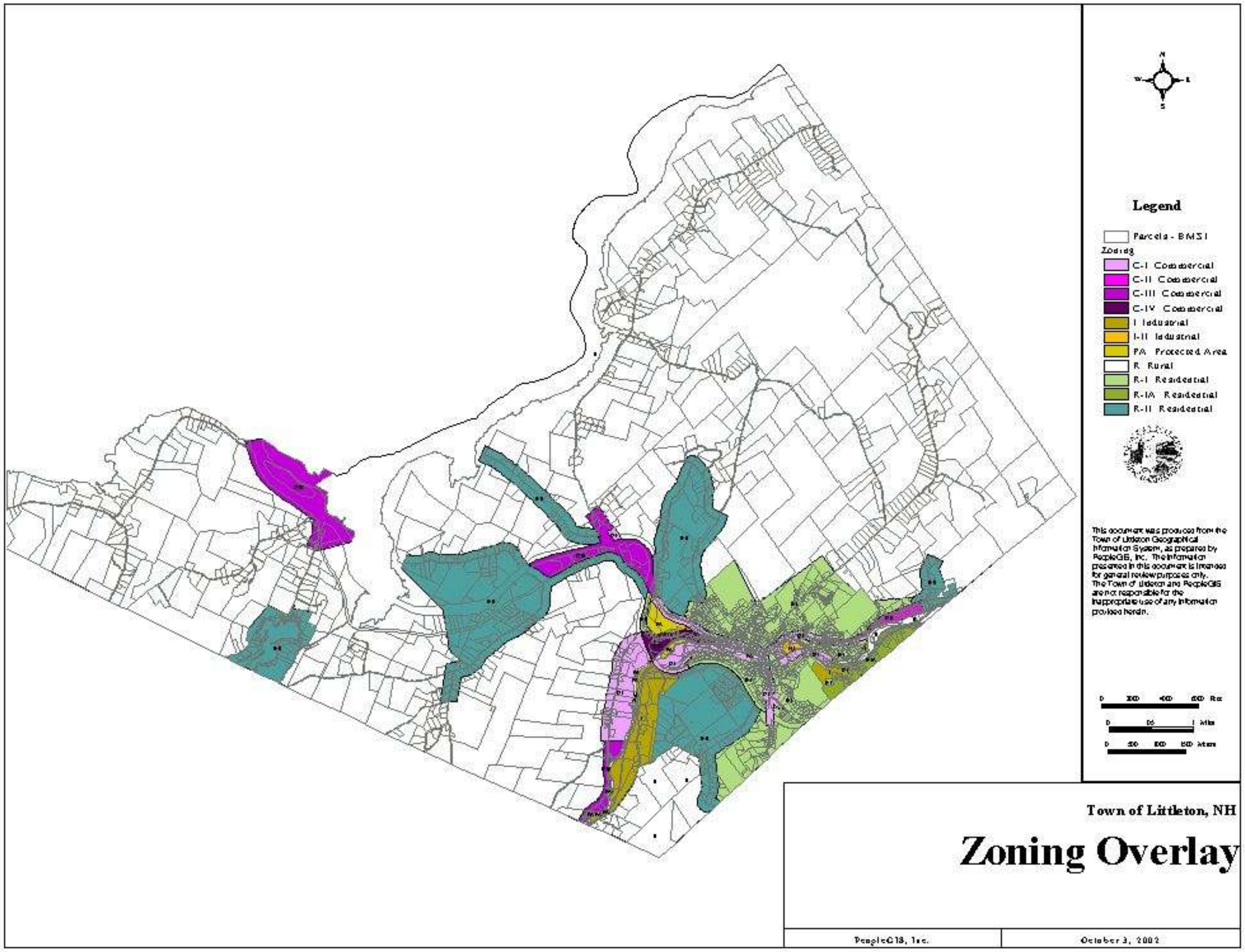
Date and amount of most recent rainfall ____

Water Temperature ______________

Weir Height ____________________

Other Notes (Weather, water appearance, stream bed)

APPENDIX B


Legend
Parcels - BMSI
Zoning
C-I Commercial
C-II Commercial
C-III Commercial
C-IV Commercial
I Industrial
I-II Industrial
PA Protected Area
R Rural
R-I Residential
R-IA Residential
R-II Residential
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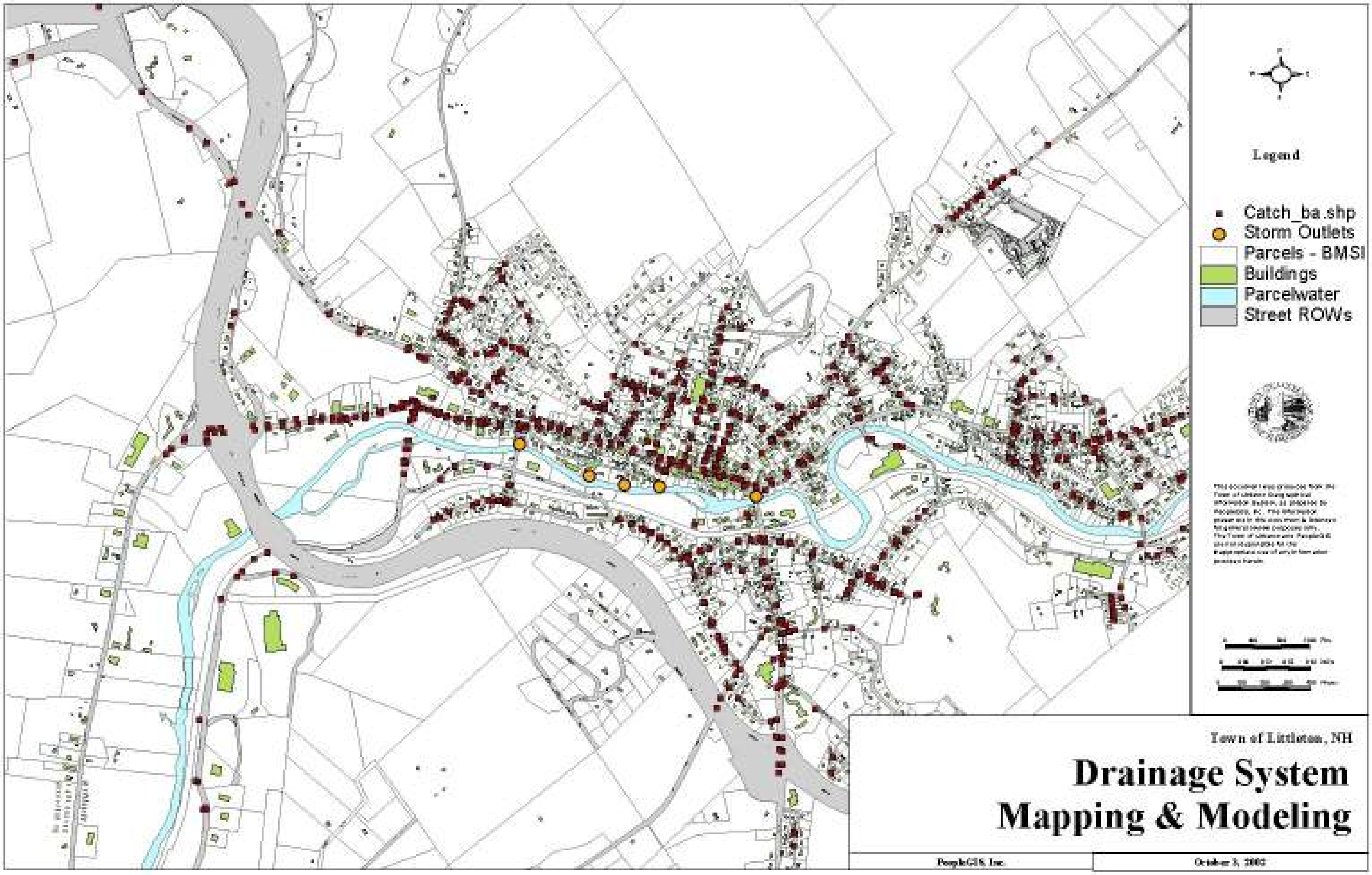
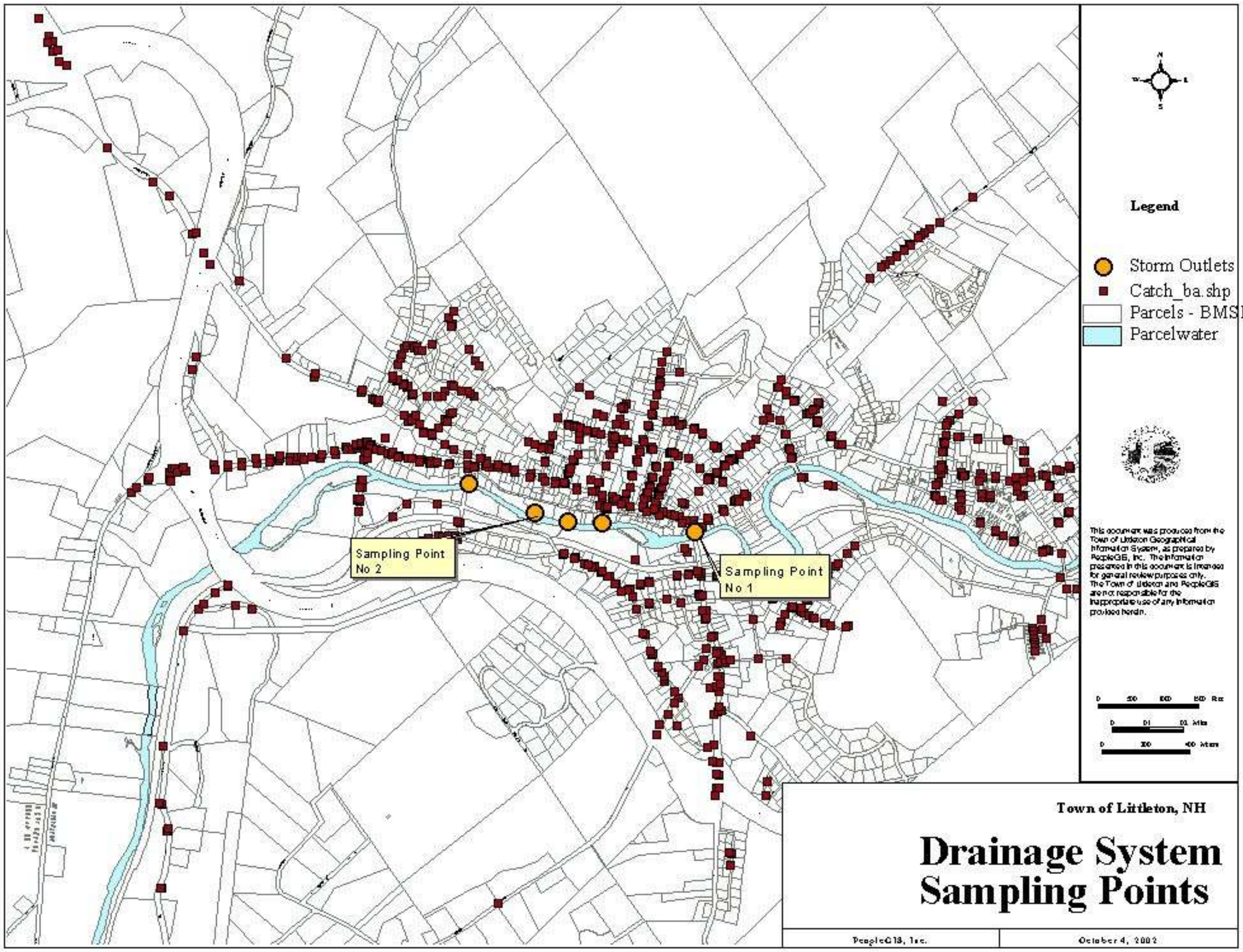
Town of Littleton, NH
Zoning Overlay
PeopleGIS, Inc.
October 3, 2002

APPENDIX C



Legend
Catch_ba.shp
Storm Outlets
Parcels - BMSI
Buildings
Parcelwater
Street ROWs
Town of Littleton, NH
Drainage System
Mapping & Modeling
PeopleGIS, Inc.

APPENDIX D


Sampling Point No 2
Sampling Point No 1
Legend
Storm Outlets
Catch_ba.shp
Parcels - BMSI
Parcelwater
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Town of Littleton, NH
Drainage System Sampling Points
PeopleGIS, Inc.
October 4, 2002